TPC-2006

User Manual

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NATIONAL INSTRUMENTS™

Worldwide Technical Support and Product Information

ni.com

National Instruments Corporate Headquarters

11500 North Mopac Expressway Austin, Texas 78759-3504 USA Tel: 512 683 0100

Worldwide Offices

Australia 1800 300 800, Austria 43 662 457990-0, Belgium 32 (0) 2 757 0020, Brazil 55 11 3262 3599, Canada 800 433 3488, China 86 21 5050 9800, Czech Republic 420 224 235 774, Denmark 45 45 76 26 00, Finland 358 (0) 9 725 72511, France 01 57 66 24 24, Germany 49 89 7413130, India 91 80 41190000, Israel 972 3 6393737, Italy 39 02 413091, Japan 81 3 5472 2970, Korea 82 02 3451 3400, Lebanon 961 (0) 1 33 28 28, Malaysia 1800 887710, Mexico 01 800 010 0793, Netherlands 31 (0) 348 433 466, New Zealand 0800 553 322, Norway 47 (0) 66 90 76 60, Poland 48 22 3390150, Portugal 351 210 311 210, Russia 7 495 783 6851, Singapore 1800 226 5886, Slovenia 386 3 425 42 00, South Africa 27 0 11 805 8197, Spain 34 91 640 0085, Sweden 46 (0) 8 587 895 00, Switzerland 41 56 2005151, Taiwan 886 02 2377 2222, Thailand 662 278 6777, Turkey 90 212 279 3031, United Kingdom 44 (0) 1635 523545

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Consult the FCC Web site at `www.fcc.gov` for more information.

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Changes or modifications not expressly approved by NI could void the user's authority to operate the equipment under the FCC Rules.

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Federal Communications Commission

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Canadian Department of Communications

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* The CE marking Declaration of Conformity contains important supplementary information and instructions for the user or installer.

Conventions

The following conventions are used in this manual:

»	The » symbol leads you through nested menu items and dialog box options to a final action. The sequence **File»Page Setup»Options** directs you to pull down the **File** menu, select the **Page Setup** item, and select **Options** from the last dialog box.
	This icon denotes a note, which alerts you to important information.
	This icon denotes a caution, which advises you of precautions to take to avoid injury, data loss, or a system crash. When this symbol is marked on a product, refer to the *Safety* section of Appendix A, *Specifications*, for information about precautions to take.
	When symbol is marked on a product, it denotes a warning advising you to take precautions to avoid electrical shock.
	When symbol is marked on a product, it denotes a component that may be hot. Touching this component may result in bodily injury.
bold	Bold text denotes items that you must select or click in the software, such as menu items and dialog box options. Bold text also denotes parameter names.
italic	Italic text denotes variables, emphasis, a cross-reference, or an introduction to a key concept. Italic text also denotes text that is a placeholder for a word or value that you must supply.
`monospace`	Text in this font denotes text or characters that you should enter from the keyboard, sections of code, programming examples, and syntax examples. This font is also used for the proper names of disk drives, paths, directories, programs, subprograms, subroutines, device names, functions, operations, variables, filenames, and extensions.
`monospace bold`	Bold text in this font denotes the messages and responses that the computer automatically prints to the screen. This font also emphasizes lines of code that are different from the other examples.

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1

General Information

This chapter includes general information about the TPC-2006 Human Machine Interface (HMI).

Introduction

The TPC-2006 touch panel computer, a state-of-the-art RISC-based HMI, includes these key features:

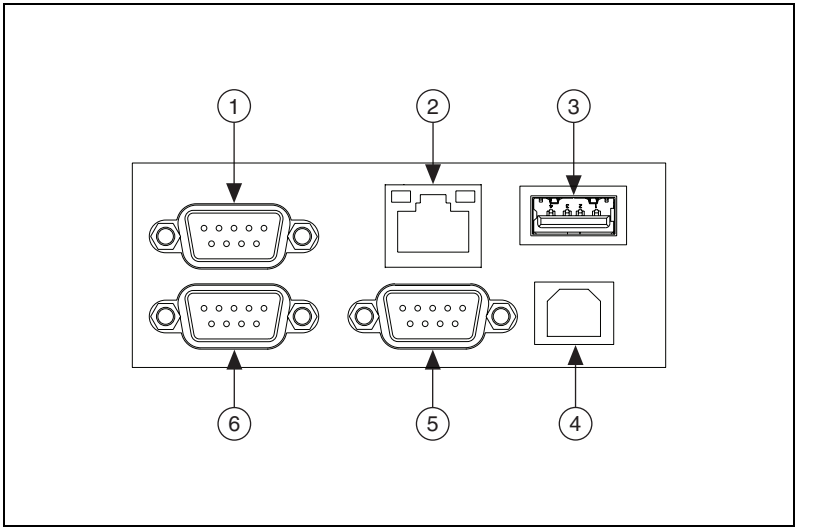
- **Fanless**—Because the system uses a low-power processor, it does not need fans, which often are unreliable and cause dust to circulate inside the equipment.
- **Bright display**—The CSTN LCD features a 5.7 in. display that meets industrial demands for clear interfaces.
- **Powerful Communication Capability**—The TPC-2006 is a powerful I/O interface for easy communication with other devices. The I/O interface includes RS232 and RS485 serial, Ethernet, and USB ports.
- **Windows CE Support**—An optional Windows CE operating system specifically for the TPC-2006 is available for Windows CE application program builders.
- **JVM Support**—The TPC-2006 is powered by JVM, which is compatible with PersonalJava 1.2.

I/O Ports

The TPC-2006 includes the following ports:

- Three serial ports: two RS232 (COM1, COM2) and one configurable as RS485 (COM4) or RS232 (COM3)
- One RJ-45 Ethernet port
- Two USB ports compliant with USB 1.1: one USB Host (Type A) and one USB Client (Type B)
- One CompactFlash 2.0 type I/II slot

Figure 1-1 shows the I/O port arrangement.



1	COM3 (RS232)/COM4 (RS485)	4	USB
2	LAN	5	COM2 (RS232)
3	USB	6	COM1 (RS232)

Figure 1-1. I/O Ports Arrangement

Storage

The TPC-2006 includes two storage methods: an onboard 64 MB NAND flash and a CompactFlash card. The system boot sequence is:

- If no CompactFlash card is installed, the system automatically boots from the onboard NAND flash.
- If a CompactFlash card is installed, the system boots from the CompactFlash card.

Cleaning

If you need to clean the unit, use a soft, nonmetallic brush. Make sure that the unit is completely dry and free from contaminants before returning it to service.

2

System Setup

This chapter includes setup information for the TPC-2006.

Important Safety Information

Before setting up the TPC-2006, read these safety instructions carefully.

Disconnect this equipment from any AC outlet before cleaning. Use a damp cloth. Do not use liquid or spray detergents for cleaning.

For plug-in equipment, the power outlet socket must be located near the equipment and must be easily accessible.

Keep this equipment away from excessive humidity.

Place this equipment on a reliable surface during installation. Dropping it or letting it fall may cause damage.

The openings on the enclosure are for air convection. Protect the equipment from overheating. *Do not cover the openings.*

Make sure the power source voltage is correct before connecting the equipment to the power outlet.

Position the power cord so that it cannot be stepped on. Do not place anything over the power cord.

All cautions and warnings on the equipment should be noted.

If the equipment is not used for a long time, disconnect it from the power source to avoid damage by transient overvoltage.

Never pour any liquid into an opening. This may cause fire or electrical shock.

Never open the equipment. For safety reasons, only qualified service personnel should open the equipment.

If one of the following situations arises, have service personnel check the equipment:

- The power cord or plug is damaged.
- Liquid has penetrated into the equipment.
- The equipment has been exposed to moisture.
- The equipment does not work well, or you cannot get it to work according to the user manual.
- The equipment has been dropped and damaged.
- The equipment has obvious signs of breakage.

Do not leave this equipment in an environment where the storage temperature may go below –20 °C (–4 °F) or above 60 °C (140 °F). Doing so could damage the equipment. The equipment should be in a controlled environment.

Caution There is a danger of explosion if the battery is incorrectly replaced. Replace the battery only with the same or equivalent type recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions.

The sound pressure level at the operator's position according to IEC 704-1:1982 is no more than 70 dB (A).

Caution The protection this equipment provides may be impaired if it is used in a manner not described in this manual.

Setup

Follow these steps to set up the TPC-2006:

1. Unpack the TPC-2006. Be sure your kit includes the following items:
   - The TPC-2006 HMI
   - Eight panel mounting clamps
   - Eight panel mounting screws
   - One 3-pin power connector
   - One HMI Resource CD

   If any items are missing or damaged, contact National Instruments.

2. Connect the power connector to 24 VDC power lines. Be sure to connect the positive, negative, and ground lines as shown in Figure 2-1. The power lines can be from either a power adapter or in-house power source.

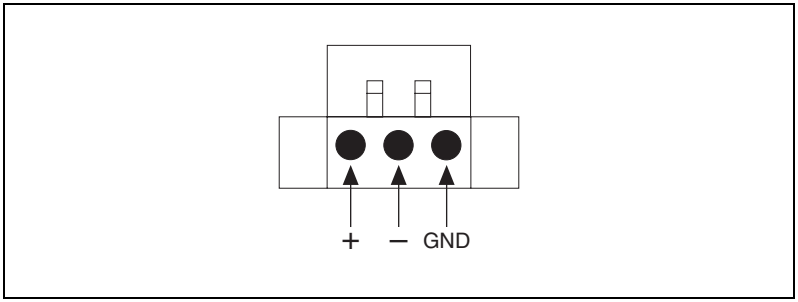


Figure 2-1. Power Connector

3. Connect the power connector to the power receptor on the TPC-2006. The power receptor pin assignment is shown in Figure 2-2.

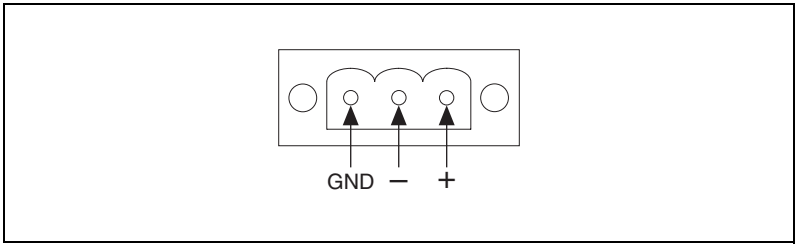


Figure 2-2. Power Receptor and Pin Assignment

4. Power on the system.

Touchscreen Calibration

The TPC-2006 touchscreen should be correctly calibrated and ready to use when you power on the system. However, if the calibration is not correct or you want to choose custom calibration options, refer to the *Touchscreen Calibration* section of Chapter 3, *System Configuration*.

Panel Mounting

Follow these steps to mount the TPC-2006 in a panel:

1. Be sure the adhesive waterproof gasket on the front bezel is in position.
2. Install the TPC-2006 into the panel opening. (Refer to Appendix A, *Specifications*, for cutout dimensions.)
3. Hook the clamps included in the accessory pack to the holes around the four sides of the bezel.
4. Insert the screws included in the accessory pack into the clamps. To fasten the TPC-2006 to the panel, tighten the screws so they push against the mounting panel.

Note The mounting panel thickness should be less than 6 mm (0.236 in.).

3

System Configuration

This chapter explains how to configure the TPC-2006.

Display Settings

Use the display settings to control the backlight brightness and screen saver, which automatically turns off the screen when the TPC-2006 is not in use for a designated time period.

Follow these steps to set the display properties:

1. Select **Start»Settings»Control Panel»Display** to access the **Display Properties** window.
2. To set the time to elapse before the backlight turns off, select the **Backlight** tab, click the **Automatically turn off backlight while on external power** checkbox and select the time from the drop-down menu.
3. To set the LCD brightness, click the **Advanced** button to access the **Advanced Backlight Options** window. Move the slider or click **+** or **–** to adjust the LCD brightness and contrast. Click **OK**.

Touchscreen Calibration

Follow these steps to calibrate the touchscreen:

1. Select **Start»Settings»Control Panel»Stylus** to access the **Stylus Properties** window.

   There are two tabs in the **Stylus Properties** window: **Double-Tap** and **Calibration**. Use Double-Tap to record the time period between two taps when double-tapping in Windows CE. Use Calibration to calibrate the touchscreen.
2. Click the **Calibration** tab and click **Recalibrate** to calibrate the touchscreen. A cross appears on the screen in the following locations: center, upper left, lower left, lower right, and upper right. Use the stylus to tap the center of the cross until it moves to next location.

Beep Settings

In Windows CE .NET, you can set the TPC-2006 to beep when you touch the touchscreen.

Follow these steps to enable or disable this function:

1. Select **Start»Settings»Control Panel»Volume & Sounds** to access the Volume and Sounds Properties window.
2. Use the controls in the **Volume** tab to set the volume and enable or disable the beep for various events and inputs.

Follow these steps to change the beep sound frequency:

1. Select **Start»Settings»Control Panel»Buzzer Settings** to access the **Buzzer Frequency Settings** window.
2. In the Buzzer Frequency Settings window, select the desired frequency.

4

Windows CE .NET

The TPC-2006 is designed for Windows CE. Windows CE is a compact operating system that occupies less storage space and uses fewer system resources than other operating systems. Its modular nature allows you to choose functions useful for a specific application. This reduces required system resources and boot time. This feature is important in industrial automation and operator interface terminals, because downtime is minimized. Also, the small storage space required allows installation on a reliable solid-state disk.

Note The TPC-2006 includes the English version of Windows CE by default. Contact National Instruments for local language support.

Note The TPC-2006 supports Remote Desktop Connection in Windows CE, but the maximum resolution supported is only 320 × 240.

TPC Utilities

Windows CE .NET on the TPC-2006 includes several useful utilities.

Soft Keyboard

The TPC-2006 is designed for small operator interfaces. Because it is inconvenient to attach a keyboard to such a small device, Windows CE .NET on the TPC-2006 includes a soft keyboard. On boot, a small keyboard icon appears in the status bar. Tap this icon with the stylus to activate or hide the soft keyboard.

TPC Configuration

The TPC-2006 includes an integrated utility to configure the basic device settings. To access the utility, click the **TPC Configurator** icon on the desktop. Navigate the configuration by tapping the four page tabs: **General**, **Network**, **Watchdog**, and **Misc**.

General

The **General** page displays basic system information. There are two main parts: **System** and **Disk & Memory**. **System** shows the OS image version and CPU type. **Disk & Memory** includes total capacity, usage, and currently available capacity of the disk and memory.

Network

The **Network** page displays information about the active network adapter. Click **Renew** to release the current IP and retrieve a new IP. Click **Ping** to ping a specified IP address to test the connection.

Click **Advanced** for more detailed IP information, including the default gateway, DHCP server, primary WINS server, and DNS server addresses.

Watchdog

Using the watchdog function, the device automatically resets if a program does not respond in time. This prevents system crashes and hangs from stopping your critical applications, as the watchdog automatically restarts the machine when required.

Use the **Watchdog** tab to set the response time, which is the period that the watchdog waits for a response.

The response time is in effect only when you select a time span and enable the watchdog. When you enable the watchdog and click the **Test** button, the no resetting signal is sent to the watchdog hardware periodically. The watchdog assumes the machine is deadlocked and reboots it after the watchdog response time. If the machine reboots as expected after the watchdog response time, the watchdog is working properly.

Misc

The **Misc** tab includes the following functions:

Caution Do *not* enter the CompactFlash folder name in the **CF Disk Name** text box directly. Renaming the CompactFlash folder to a name not on the list causes irreversible problems with application program settings.

- Use **Startup Programs** to set the startup programs without editing. The programs listed under **Startup Programs** are automatically executed after the system has successfully booted. Click **Add** to add a file to the startup. Click **Delete** to remove a file from the startup.

Note Do *not* try to insert a nonexecutable file into the startup program.

- Use **Reboot** to reboot the TPC-2006.

  There are two additional ways to reboot the system: clicking the machine icon in the status bar and executing the `reboot.exe` command through a command line program.
- Use the **Registry** options to save and view registry information. Click **Save** to save the registry to a solid state disk. Click **View** to view, edit, create, or delete registry information. You also can back up or restore the registry setting by clicking **Backup** or **Restore**.

Note You cannot back up and restore over different image versions.

- Use **Web Server Root** to enter the web server root path. The root path takes effect only after rebooting the machine.
- Use **Ftp Server Root** to enter the FTP server root path. The root path takes effect only after rebooting the machine.

Tools

Select **Start»Programs»Utilities** to access the following tools.

Note For best results when accessing these tools, click the arrow to the right of the **Utilities** menu to avoid accidentally selecting a submenu item.

ActiveSync

ActiveSync synchronizes data and monitors the connection between the TPC-2006 and host computer. By default, ActiveSync executes automatically when you use it to establish a connection to a target device.

Registry Editor

Use Registry Editor to view, edit, enter, delete, or save registry data.

Registry Saver

Use Registry Saver to save the system registry. In a command line environment, you can execute Registry Saver using `regsave.exe` or `regsave.exe -s` for the silence mode.

Remote Display Application

Remote Display Application displays a Windows CE device screen on a remote desktop. It works with the Windows CE Remote Display Host application.

Because the connection is over the network, the host machine and TPC-2006 network functions must work properly. You must execute Remote Display Host (`cerhost.exe`) on a remote host desktop. Also, you must run Remote Display Application on the TPC-2006. In the CE Remote Display window, click **Connect** and enter the hostname or IP address.

After successfully establishing the connection, you can see the TPC-2006 display and control it from the host machine.

TPC CE Notepad

TPC CE Notepad is a text editor.

TPC Configurator

TPC Configurator is an integrated utility for configuring the basic TPC-2006 settings. For more information, refer to *TPC Configuration*.

TPC Version Information

TPC Version Information shows the OS version information.

Other Utilities

The following utilities are command line-executed programs without graphical user interfaces. To execute these utilities, type the command names and parameters as shown below.

Bright.exe [Level]:

Sets the display brightness level. The parameters are 1 to 10.

Buzzer.exe [frequency] [duration]:

Plays a beep. Use parameters to set the frequency in Hertz and duration in milliseconds. If you do not use parameters, the default frequency is 350 Hz and default duration is 30 ms.

Contrast.exe [Level]:

Sets the display contrast. The parameters are 1 to 10.

RegSave.exe [-s]:

Saves the registry settings. If you use `RegSave.exe -s`, no message box is displayed whether you are successful or fail.

Reboot.exe:

Saves the registry settings and reboots the TPC-2006.

Screen.exe [on/off]:

Turns the display on/off. Use `Screen.exe on` to turn on and `Screen.exe off` to turn off the display.

Iesample.exe [-n] [-f] [ip address/ folder name]:

Launches Internet Explorer. Use `Iesample.exe -n` to close the scroll bar. Use `Iesamples.exe -f` to activate the full screen. The parameters can be blank.

Networking

Networking Via Ethernet

Follow these steps to configure the TPC-2006 Ethernet port:

Note Be sure you are connected to a LAN before booting the system.

Note The data transfer buffer size per package via Ethernet is about 20,000.

1. Select **Start»Settings»Network and Dial-up Connections**.
2. A window displaying all available connections appears. Double-click the icon for the connection you want to configure.
3. Select the **IP Address** tab and select **Obtain an IP address via DHCP**.
4. Select the **Name Servers** tab and enter the server addresses.
5. Select **Start»Run**. Enter `regsave` to save the registry settings to a storage card.

Networking Via the Serial Port

This section explains how to set up the connection between the TPC-2006 and a host PC via ActiveSync.

ActiveSync Setup

Follow these steps to set up ActiveSync:

1. Insert the TPC series support CD into the host PC CD-ROM.
2. Install the TPC software development kit for eVC++.
3. Install ActiveSync.
4. Connect the host computer and TPC with a null modem cable (included in the kit). Make sure the connection is solid on both RS232 serial ports.
5. Set up the TPC-2006 and host communication environments as described below.

Setting Up the TPC-2006 Communication Environment

Note Before completing this section, change to the small system font size. Go to **Start»Programs»Utilities»System Font Setting**. Click **Small System Font Size**. Click **OK**. A confirmation appears, saying **`This will change the system font size and reboot! Are you sure?`**. Click **YES**.

Follow these steps to set up the TPC-2006 communication environment:

1. To configure COM1 on the TPC-2006, select **Start»Settings»Control Panel**.
2. Double-click the **PC Connection** icon.
3. Click **Change** to select the COM port.
4. In the Change Connection window, enter `Serial1`.
5. Click **Enter** (the return arrow symbol) on the soft keyboard to confirm the change.
6. The PC Connection Properties window should display **Serial1** in the **Connect using:** field.

Setting Up the Host Communication Environment

Follow these steps to set up the host communication environment:

1. Double-click the ActiveSync icon on the host computer.
2. In the Microsoft ActiveSync window, select **File»Connection Settings**.
3. In the Connection Settings window, select **Allow serial cable or infrared connection to the COM port**, **Allow network (Ethernet) and Remote Access Service (RAS) server connection with this desktop computer**, and **Show status icon in Taskbar**.
4. Click **Get Connected**. The Get Connected window appears. Do not click **Next** at this time.
5. On the TPC-2006, select **Start»Run**. Enter `\Windows\repllog.exe` and click **OK**.
6. In the Get Connected window on the host computer, click **Next**.

   When the TPC and the host PC are connected, the Connected to My Connection window appears.
7. The New Partnership window appears on the host computer. Select **No** and click **Next**.
8. Click **Explore** in the Microsoft ActiveSync window. The Mobile Device appears, displaying the TPC-2006 file resources and information. For example, you could click **My Documents** to see documents on the TPC-2006.

Networking via the USB Client Port

In addition to connecting via a null modem cable as described in the previous section, you can also connect via the client USB port. To do this, you must install ActiveSync on the host computer. Then use a USB cable to connect the client and host USB ports. Be sure the TPC-2006 PC connection setting is USB Socket Default (the default setting). Then follow the steps above to connect the TPC-2006 and host automatically.

A

Specifications

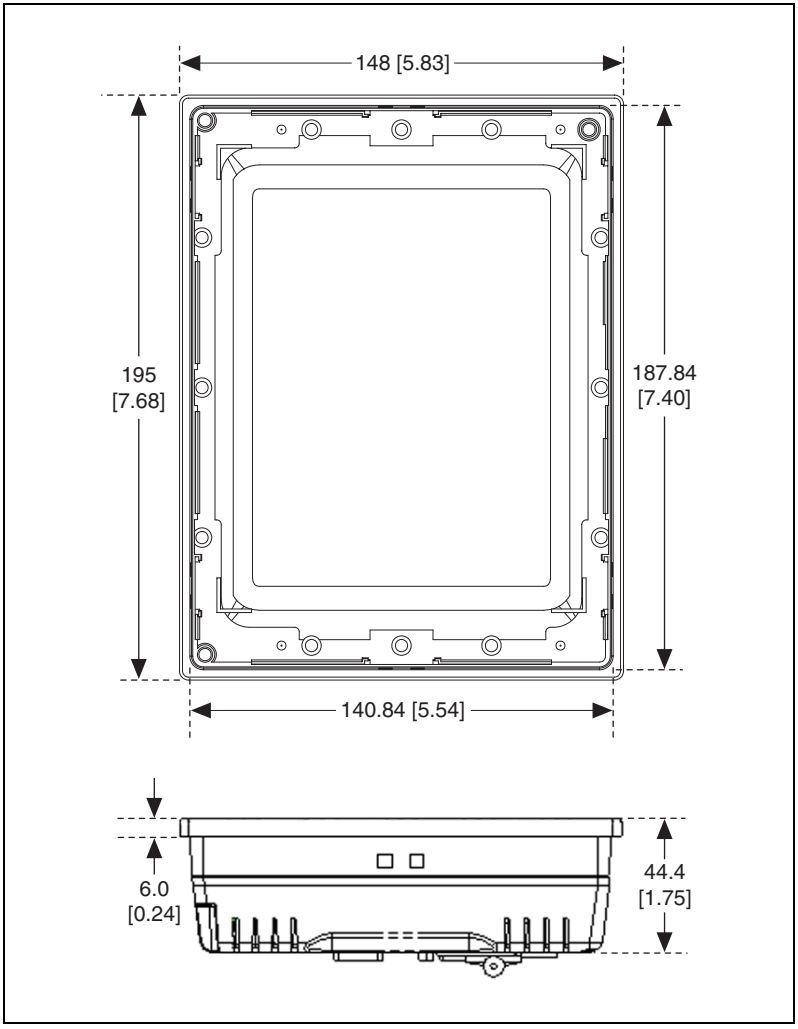
This appendix lists the TPC-2006 system specifications.

Physical

Weight ..... 0.8 kg

Cutout dimensions..... 188 × 141 mm (suggested)

Dimensions



System Kernel

CPU .....Samsung S3C2410A-26, 266 MHz

BIOS .....Samsung NAND flash memory

VGA.....Samsung S3C2410A-26 Integrated

DRAM	Built-in 64 MB SDRAM
Storage memory	Built-in Samsung 64 MB NAND flash
Ethernet	DM9000E 10/100Base-T Ethernet controller; IEEE 802.3u protocol compatible
Watchdog timer	Samsung S3C2410A watchdog timer; 2, 5, 10, 15, 30, 40 s timeout period option
CompactFlash	CompactFlash type I/II

LCD

Display type	Color STN LCD
Size (diagonal)	5.7 in.
Maximum resolution	320 × 240 (QVGA)
Maximum colors	256
Pixel pitch (W × H, mm)	0.12 × 0.36
Viewing angle	110°
Luminance (cd/m2)	201
Contrast ratio	35
Operating temperature	0 to 50 °C (ambient)
Control	Contrast adjustable
Backlight	1 CCFL
LCD MTBF	100,000 h
Backlight MTBF	40,000 h

Touchscreen

Touch type .....Resistive

Base glass construction.....Tempered glass

Resolution .....Continuous

Light transmission .....75% typical

Controller.....SPI (AD7846)

Power rating.....5 VDC

Software driver .....Windows CE (embedded)

Durability.....100 million touches

Note No pointer/cursor appears when using the touchscreen. The cursor appears only when closing or minimizing the window.

Power

Input voltage .....24 VDC (the fuse becomes an open circuit if input level exceeds 33 VDC)

Maximum current .....2 A

Fuse

Rating.....F5A 250 V

Size .....5 × 20 mm

Note When replacing the fuse, use only a fuse of the same type and rating.

Note The fuse is set to break if the input voltage exceeds 33 VDC.

Environment

Operating temperature .....0 to 50 °C

Storage temperature.....–20 to 70 °C

Humidity ..... 10 to 95% at 40 °C relative humidity (noncondensing)

Vibration ..... 10 to 18 Hz at 1.5 mm peak-to-peak displacement; 18 to 500 Hz at 1 G acceleration

Maximum altitude ..... 2,000 m

Pollution Degree 2

Indoor use only

Safety

This product is designed to meet the requirements of the following standards of safety for information technology equipment:

- IEC 60950-1, EN 60950-1
- UL 60950-1, CSA 60950-1

Note For UL and other safety certifications, refer to the product label or visit `ni.com/certification`, search by model number or product line, and click the appropriate link in the Certification column.

Electromagnetic Compatibility

This product is designed to meet the requirements of the following standards of EMC for electrical equipment for measurement, control, and laboratory use:

- EN 55024, CISPR 24 EMC requirements
- EN 55022, CISPR 22 Emissions; Class A
- CE, C-Tick, ICES, and FCC Part 15 Emissions; Class A

Note For EMC compliance, operate this device according to product documentation.

CE Compliance

This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:

- 2006/95/EC; Low-Voltage Directive (safety)
- 2004/108/EEC; Electromagnetic Compatibility Directive (EMC)

Note Refer to the Declaration of Conformity (DoC) for this product for any additional regulatory compliance information. To obtain the DoC for this product, visit `ni.com/certification`, search by model number or product line, and click the appropriate link in the Certification column.

Environmental Management

National Instruments is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial not only to the environment but also to NI customers.

For additional environmental information, refer to the *NI and the Environment* Web page at `ni.com/environment`. This page contains the environmental regulations and directives with which NI complies, as well as any other environmental information not included in this document.

Waste Electrical and Electronic Equipment (WEEE)

EU Customers At the end of their life cycle, all products *must* be sent to a WEEE recycling center. For more information about WEEE recycling centers and National Instruments WEEE initiatives, visit `ni.com/environment/weee.htm`.

电子信息产品污染控制管理办法 （中国 RoHS）

中国客户 National Instruments 符合中国电子信息产品中限制使用某些有害物质指令 (RoHS)。关于 National Instruments 中国 RoHS 合规性信息，请登录 `ni.com/environment/rohs_china`。(For information about China RoHS compliance, go to `ni.com/environment/rohs_china`.)

Mercury Disposal and Recycling

LCD lamp(s) in this monitor contain mercury. Dispose or recycle according to local, state or federal laws. Consult the Electronic Industries Alliance at `www.eiae.org` for more information. For specific information on lamp disposal, consult `www.lamprecycle.org`.

Cleaning

If you need to clean the unit, use a soft, nonmetallic brush. Make sure that the unit is completely dry and free from contaminants before returning it to service.

B

Watchdog Timer Programming

Windows CE includes a watchdog timer for the TPC-2006. You can access the timer through the WIN32 API. The TPC-2006 includes a WDT driver, WDT1:, for enabling/disabling the watchdog timer. You must open this driver before using the resources, and then use the DeviceIOControl function to enable/disable the watchdog timer.

This appendix describes DeviceIOControl and it parameters. It also includes a programming example.

DeviceIOControl

DeviceIOControl sends a control code directly to a specified device driver, causing the corresponding device to perform the specified operation. The function and its parameters are:

```
BOOL DeviceIoControl( HANDLE hDevice, DWORD
dwIoControlCode, LPVOID lpInBuffer, DWORD nInBufferSize,
LPVOID lpOutBuffer, DWORD nOutBufferSize, LPDWORD
lpBytesReturned, LPOVERLAPPED lpOverlapped );
```

Parameters

DeviceIOControl includes the following parameters:

- `hDevice`

  (in) Handle to the device that performs the operation. Call the CreateFile function to obtain a device handle.

- `dwIoControlCode`

  (in) Specifies the operation control code. This value identifies the specific operation to be performed and the type of device on which the operation is to be performed. No specific values are defined for the `dwIoControlCode` parameter. However, if you write a custom device driver, you can define `IOCTL_XXXX` control codes, per the `CTL_CODE` macro. You then can advertise these control codes, and an application can use these control codes with DeviceIoControl to perform driver-specific functions.

- `lpInBuffer`

  (in) Long pointer to a buffer that contains the data required to perform the operation. This parameter can be NULL if the `dwIoControlCode` parameter specifies an operation that does not require input data.

- `nInBufferSize`

  (in) Size, in bytes, of the buffer pointed to by `lpInBuffer`.

- `lpOutBuffer`

  (out) Long pointer to a buffer that receives the operation's output data. This parameter can be NULL if the `dwIoControlCode` parameter specifies an operation that does not produce output data.

- `nOutBufferSize`

  (in) Size, in bytes, of the buffer pointed to by `lpOutBuffer`.

- `lpBytesReturned`

  (out) Long pointer to a variable that receives the size, in bytes, of the data stored into the buffer pointed to by `lpOutBuffer`. The `lpBytesReturned` parameter cannot be NULL. Even when an operation produces no output data, and `lpOutBuffer` can be NULL, DeviceIoControl makes use of the variable pointed to by `lpBytesReturned`. After such an operation, the variable value has no meaning.

- `lpOverlapped`

  (in) Ignored; set to NULL.

- Return Values

  Nonzero indicates success. Zero indicates failure. To get extended error information, call GetLastError.

How to Use the Control Codes

There are six control codes for the WDT driver operation codes.

IOCTL _WDT_ENABLE

Enables the application watchdog timer. By default, if the watchdog timer is enabled, the WDT driver automatically triggers itself after the specified period, and your application does not need to trigger the watchdog timer.

- `lpInBuffer`: unused
- `nInBufferSize`: unused

- `lpOutBuffer`: unused
- `nOutBufferSize`: unused

IOCTL _WDT_DISABLE

Disables the application watchdog timer.

- `lpInBuffer`: unused
- `nInBufferSize`: unused
- `lpOutBuffer`: unused
- `nOutBufferSize`: unused

IOCTL_WDT_STROBE

Triggers the watchdog. If your application uses IOCTL_WDT_ENABLE to enable the watchdog first and then sends IOCTL_WDT_REBOOT to the WDT driver, your application must trigger the watchdog once during the watchdog timer period. If your application has not triggered at the specified period, the device reboots automatically.

- `lpInBuffer`: unused
- `nInBufferSize`: unused
- `lpOutBuffer`: unused
- `nOutBufferSize`: unused

IOCTL_WDT_GETTIMEOUT

Gets the watchdog time setting.

- `lpInBuffer`: unused
- `nInBufferSize`: unused
- `lpOutBuffer`: The DWORD points to your watchdog time setting. The watchdog time settings are:

Setting	Time
0	2 s
1 (default)	5 s (default)
2	10 s
3	15 s
4	30 s

Setting	Time
5	45 s
6	60 s

- `nOutBufferSize`: unused

IOCTL_WDT_SETTIMEOUT

Sets the watchdog time setting.

- `lpInBuffer`: The DWORD points to your watchdog time setting. The watchdog time settings are:

Setting	Time
0	2 s
1 (default)	5 s (default)
2	10 s
3	15 s
4	30 s
5	45 s
6	60 s

- `nInBufferSize`: unused
- `lpOutBuffer`: unused
- `nOutBufferSize`: unused

IOCTL_WDT_REBOOT

If you want your application to trigger the watchdog, use IOCTL_WDT_REBOOT to notify the watchdog driver timer (WDT). Otherwise, the WDT triggers itself automatically.

- `lpInBuffer`: unused
- `nInBufferSize`: unused
- `lpOutBuffer`: unused
- `nOutBufferSize`: unused

Programming Example

```
#define WDT_CODE(ID) CTL_CODE(FILE_DEVICE_UNKNOWN,ID, METHOD_BUFFERED,
FILE_ANY_ACCESS)
#define IOCTL_WDT_ENABLE WDT_CODE (0x900)
#define IOCTL_WDT_DISABLE WDT_CODE(0x901)
#define IOCTL_WDT_STROBE WDT_CODE(0x902)
#define IOCTL_WDT_GET_TIMEOUT WDT_CODE(0x903)
#define IOCTL_WDT_SET_TIMEOUT WDT_CODE(0x904)
#define IOCTL_WDT_REBOOT WDT_CODE(0x905)
// for compatibility reasons, you can define IOCTL as below:
// #define IOCTL_WDT_ENABLE 0x1001
// #define IOCTL_WDT_DISABLE 0x1002
// #define IOCTL_WDT_STROBE 0x1003
// #define IOCTL_WDT_GETTIMEOUT 0x1004
// #define IOCTL_WDT_SETTIMEOUT 0x1005
// #define IOCTL_WDT_REBOOT 0x1006
HANDLE m_hWDT=NULL;
TCHAR szClassName[60];
// assign the WDT driver name wsprintf(szClassName, TEXT("WDT1:"));
// Open the WDT driver
m_hWDT = CreateFile(szClassName, GENERIC_READ GENERIC_WRITE, 0, NULL,
OPEN_EXISTING, FILE_ATTRIBUTE_NORMAL, NULL);
if ( m_hWDT == INVALID_HANDLE_VALUE ) { DebugMsg(CString("WDT driver fail"));
return;
}
DWORD dwTemp; DWORD nIndex=2;
// Set the Watchdog Timer as 10 seconds. Number 2 means 10 seconds.
DeviceIoControl(m_hWDT, IOCTL_WDT_SET_TIMEOUT, &nIndex, sizeof(nIndex),
NULL, 0, &dwTemp, NULL);
// Enable the Watchdog timer
DeviceIoControl(m_hWDT, IOCTL_WDT_ENABLE, NULL, 0, NULL, 0, &dwTemp, NULL);
While (1) {
// do your job here.
Sleep(8000);
DeviceIoControl(m_hWDT, IOCTL_WDT_STROBE, NULL,0, NULL, 0, &dwTemp, NULL);
}
DeviceIoControl(m_hWDT, IOCTL_WDT_DISABLE, NULL, , NULL, 0, &dwTemp, NULL);
CloseHandle(m_hWDT);
```

C

Fuse Replacement

Caution *Do not* replace the fuse unless it is damaged. *Do not* replace the fuse with a differently rated fuse. For more information, see the fuse specifications in Appendix A, *Specifications*.

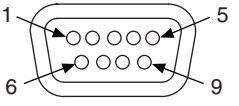
Follow these steps to replace the fuse:

1. Remove the power cable.
2. Remove the fuse cover.
3. Replace the damaged fuse with a new one.
4. Place the fuse cover back into position.
5. Replace the power cable.

D

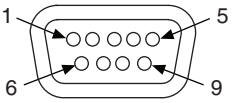
Pin Assignments

RS232 Pin Assignment



Pin Number	Description
Pin 1	DCD
Pin 2	Rx
Pin 3	Tx
Pin 4	DTR
Pin 5	GND
Pin 6	DSR
Pin 7	RTS
Pin 8	CTS
Pin 9	RI

RS485 Pin Assignment



Pin Number	Description
Pin 1	DATA–
Pin 2	No Connection
Pin 3	No Connection
Pin 4	DATA+
Pin 5	GND
Pin 6	No Connection
Pin 7	No Connection
Pin 8	No Connection
Pin 9	No Connection

COM Port Setting

The TPC-2006 includes three COM ports: RS232 (COM1 and COM2), and 4-wire RS232 (COM3) or RS485 (COM4). COM3 and COM4 share the same DB9 connector, which you can set through the software.

E

Technical Support and Professional Services

Visit the following sections of the National Instruments Web site at ni.com for technical support and professional services:

- **Support**—Online technical support resources at ni.com/support include the following:
  - **Self-Help Resources**—For answers and solutions, visit the award-winning National Instruments Web site for software drivers and updates, a searchable KnowledgeBase, product manuals, step-by-step troubleshooting wizards, thousands of example programs, tutorials, application notes, instrument drivers, and so on.
  - **Free Technical Support**—All registered users receive free Basic Service, which includes access to hundreds of Application Engineers worldwide in the NI Discussion Forums at ni.com/forums. National Instruments Application Engineers make sure every question receives an answer.

    For information about other technical support options in your area, visit ni.com/services or contact your local office at ni.com/contact.
- **Training and Certification**—Visit ni.com/training for self-paced training, eLearning virtual classrooms, interactive CDs, and Certification program information. You also can register for instructor-led, hands-on courses at locations around the world.
- **System Integration**—If you have time constraints, limited in-house technical resources, or other project challenges, National Instruments Alliance Partner members can help. To learn more, call your local NI office or visit ni.com/alliance.

If you searched ni.com and could not find the answers you need, contact your local office or NI corporate headquarters. Phone numbers for our worldwide offices are listed at the front of this manual. You also can visit the Worldwide Offices section of ni.com/niglobal to access the branch office Web sites, which provide up-to-date contact information, support phone numbers, email addresses, and current events.

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